5.4 Proposed Guidelines

5.4.1 Late Hour / Low Volume Timing Period Determination

The nighttime period is characterized by a heavy drop in traffic volumes to the level where operating the signals in coordinated mode is no longer as efficient. Although the typical nighttime period is from 10 p.m. to 6 a.m., this is not always the case. In determining the exact late night hours in which alternative traffic operation modes should be considered, a list of criterion has been developed. It should be noted that due to the unique characteristics of each corridor, engineering judgment should also be utilized in developing the exact time period in which the following modes of operation should be implemented.

Flashing Operation

LOS 'B' was chosen as the threshold intersection operation LOS because it is defined by the *Highway Capacity Manual* (HCM) as "stable operation / minimal delays: an occasional approach phase is fully utilized. Many drivers begin to feel somewhat restricted within platoons of vehicles".

Through examination of various major corridors in Lincoln, volumes that represent approximately 25% of the PM Peak period volumes at a critical intersection along a sub-system result in the reduction of delay at the intersection to a low LOS 'B' (close to LOS 'A'). Due to the nature in which intersections operate under LOS 'B' or better and the arrival pattern of vehicles, developing platoons of vehicles for coordination is difficult. As a result, during these low volume periods, signal timing coordination would not result in much of a benefit. In addition, flashing signal operation can only be safe at low volume intersections. The operation of an intersection at 25 percent of its PM Peak volume does result in lower turning movement volumes such that safety would not be compromised from the standpoint of traffic volume. However, there are other considerations (i.e. sight distance) that should also be considered in developing flashing operation methodologies.

Figures 8 and 9 provide late night hour volume information for North 27th Street and Highway 2, respectively. In calculating the time period to provide flashing operation, the most conservative approach was taken. This was achieved by using volume information from the intersection with the largest delay.

- North 27th Street: Along North 27th Street, between "P" Street and Kensington Drive, the intersection with the highest delay is 27th Street at Vine Street. This intersection operates with a PM Peak delay of 40.6 seconds per vehicle (LOS 'D'). As shown in Figure 8, twenty-five percent of the 27th Street PM Peak through movement volume at Vine Street provides the time period in which flashing operation could be implemented (11:30 p.m. to 5:00 a.m.).

- Highway 2: Along Highway 2, between Old Cheney Road and Van Dorn Street, the intersection with the highest delay is Highway 2 at 14th Street. This intersection

operates with a PM Peak delay of 45.1 seconds per vehicle (LOS 'D'). As shown in Figure 9, twenty-five percent of the Highway 2 PM Peak through movements at 14th Street provides the time period in which flashing operation could be implemented (11:30 p.m. to 5:00 a.m.).

The time period calculated for flashing operation along North 27th Street and Highway 2 are similar, 11:30 PM to 5:00 AM. It should be noted that this analysis only provides information on when flashing operation could be implemented. It does not determine whether or not flashing operation should be implemented. Figure 10 presents late night hour volume information at cross street intersections along 27th Street. A review of this figure also illustrates a large drop in traffic volumes along 27th Street's cross streets starting at 11:30 PM and a sudden increase after 5:00 AM. Figure 11 presents late night hour volume information at cross street intersections along Highway 2. A review of this figure also illustrates a large drop in traffic volumes along Highway 2 cross streets starting at 11:30 PM and a sudden increase after 5:00 AM. Appendix D presents more detailed volume information along 27th Street and Highway 2. A similar analysis is required for each corridor under study for possible flashing operation.

Free Operation

Similar to the flashing operation methodology, LOS 'B' was chosen as the threshold intersection operation level of service because it is defined by the HCM as "Stable operation / minimal delays: an occasional approach phase is fully utilized. Many drivers begin to feel somewhat restricted within platoons of vehicles".

Through examination of various major corridors in Lincoln, volumes that represent approximately 40% of the PM Peak period volumes at a critical intersection along a sub-system result in the reduction of delay at the intersection to high LOS 'B' (close to LOS 'C') operation. Similarly, due to the nature in which intersections operate under LOS 'B' or better and the arrival pattern of vehicles, developing platoons of vehicles for coordination is difficult. As a result, during these low volume periods, signal timing coordination would not result in much of a benefit. This intersection LOS was consistently achieved between the hours of 10:30 PM and 5:30 AM. In comparison to flashing operation and the basic definition and purpose of a signalized intersection, a signal in free operation has a higher capacity and can process more vehicles in a safe manner. The operation of an intersection at 40 percent of its PM Peak volume does result in turning movement volumes such that safety would not be compromised from the standpoint of traffic volume. It should be noted, however, that there are other considerations (i.e. vehicle composition and speeds) that should also be considered in developing free operation methodologies.

Figures 12 and 13 provide late night hour volume information for North 27th Street and Highway 2, respectively.

- North 27th Street: Along North 27th Street between "P" Street and Kensington Drive, the intersection with the highest delay is 27th Street at Vine Street. This

intersection operates with a delay of 40.6 seconds per vehicle (LOS 'D') during the PM Peak. As shown in Figure 12, 40% of the 27th Street PM Peak through movement volume at Vine Street provides the time period in which "free" operation could be implemented (10:30 p.m. to 5:30 a.m.).

- Highway 2: Along Highway 2 between Old Cheney Road and Van Dorn Street, the intersection with the highest delay is Highway 2 at 14th Street. This intersection operates with a PM Peak delay of 45.1 seconds per vehicle (LOS 'D'). As shown in Figure 13, 40 percent of the Highway 2 PM Peak through movement volume at 14th Street provides the time period in which "free" operation could be implemented (10:30 PM to 5:30 AM).

Appendix D provides late-night two-way hourly volume information along other corridors in the City of Lincoln.